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PATENT AND TECHNICAL TRANSLATION

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DECLARATION

The undersigned, Olaf Bexhoeft, hereby states that he is well acquainted with both the English and German languages and that the attached is a true translation to the best of his knowledge and ability of the German text of PCT/EP2005/000895, filed 01/29/2005, and published on 09/01/2005 as WO 2005/081091 A3.

The undersigned further declares that the above statement is true; and further, that this statement was made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or document or any patent resulting therefrom.

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Assembly of Devices

The invention relates to a device arrangement with at least one switchgear cabinet and one cooling device, wherein the switchgear cabinet has a closed interior in which electrical built-ins can be housed, wherein the cooling device is installed in the area of a lateral surface of the switchgear cabinet which extends vertically in respect to the front and at least over a portion of the height of the switchgear cabinet, and is in spatial connection with the interior through at least one air inlet and at least one venting opening, and wherein the cooling device has a receiving chamber with at least one heat exchanger housed therein.

Such a device arrangement is known from the company catalog of Rittal, Manual 30, page 448. In this case the cooling device has a closed housing, which can be installed on the switchgear cabinet in place of a door or a lateral wall. A heat exchanger has been placed into the housing, which is in a spatial connection with the interior of the switchgear cabinet. Air is drawn off the ceiling area of the switchgear cabinet, is cooled in the heat exchanger and is supplied to it again in the floor area. For reasons of space the interiors of switchgear cabinets are increasingly more densely packed. Because of this a larger amount of waste heat is generated, which must be removed. With equipment of such a type, the cooling device must be exchanged for a device with higher cooling output.

It is the object of the invention to create a device arrangement of the type mentioned at the outset which can be

easily adapted to changing cooling demands.

This object is attained in that the receiving chamber of the cooling device is divided at least partially into two or more partial receiving chambers, which are arranged vertically on top of each other, and that a cooling module is housed in at least one of the partial receiving chambers.

The receiving chamber of the cooling device is embodied in such a way that it can be modularly equipped with one or several heat exchanger unit. In this way the cooling device can be individually matched to increasing demands. In accordance with the invention, the receiving chamber of the air-conditioning device is vertically divided. In this case zones can be formed as required, by means of which cooling areas, which are analogously placed on top of each other, can be created in the interior of the switchgear cabinet. It is possible in this way to prevent areas of a high thermal level being created by rising heat.

A defined air guidance can be achieved in a simple manner when it is provided that, on their side facing the switchgear cabinet, the partial receiving chambers are closed by means of a cover, that the cover constitutes the air inlet and the venting opening, and that a sealing element arranged on the outside of the cover in the area between the air inlet and the venting opening prevents a short circuit of the air.

If it is provided that the cooling module has a heat exchanger unit and at least one fan unit as separate components, the cooling module can be easily manipulated. This is particularly advantageous in case of tight spaces. For example, a walkway of a width of only 80 cm is formed between switchgear cabinets in computer centers. By means of the instant invention the cooling module can be easily put

together from its components in the partial receiving chambers.

A stable construction of the cooling devices results if it is provided that the cooling device has a rack put together from horizontal and vertical profiled frame elements, wherein the profiled frame elements are connected with each other in the corners of the rack, that compartment floors are horizontally fastened on the rack for dividing the partial receiving chamber, and that the cooling module(s) can be placed on the compartment floors. If it is additionally provided in this case that the cooling module or the partial components (in accordance with claim 3) have a structural width which is less than the clear opening dimension between the two vertical profiled frame elements at the front of the rack, the cooling module can be installed from the front of the device and/or the rear. This is of particular advantage if there is no, or only insufficient, lateral access to the cooling device provided because of limited space.

A structural variation of the device arrangement can be designed, for example, in such a way that, on its side facing away from the switchgear cabinet, the cooling device is sealingly closed off by means of a wall element.

However, it is also conceivable that the cooling device is installed between two switchgear cabinets, and that the partial receiving chambers can be selectively brought into an air-conducting connection with the interior chambers of one or both switchgear cabinets. In this way it is possible to air-condition two switchgear cabinets simultaneously with a single cooling device.

A possible variation of the invention is such that the cooling device has a feed and a return line, through which

coolant can be conveyed, and that the heat exchanger units can be connected to the feed and the return lines. The feed and return lines can be connected, for example, to an external re-cooling installation. The supply of the heat exchanger units with cooling output is thus solved in a simple way.

If in connection with this it has been additionally provided that the feed and return lines have rapid coupling devices, which can be connected and disconnected without dripping, specialists are not absolutely required for connecting the cooling modules.

A preferred application of the invention is provided in that the electrical installations are embodied as server units, which have cooling conduit structures extending in the direction of the switchgear cabinet interior, and that the venting opening of the cooling conduit structure is assigned to the front of the switchgear cabinet, and the air inlet to the area of the rear of the switchgear cabinet.

The invention will be explained in greater detail in what follows by means of exemplary embodiments represented in the drawings. Shown are in:

Fig. 1, a cooling device in a perspective lateral representation, and

Fig. 2, a device arrangement consisting of two switchgear cabinets and the air-conditioning device represented in Fig. 1.

A cooling device 10 with a rack is represented in Fig. 1. It has been put together from twelve profiled frame elements 11, 12, 13. The horizontal profiled frame elements 11, 12 form a bottom and cover frame, into whose corner areas the four vertical profiled frame elements 13 of identical

cross section have been welded. The receiving chamber formed by the rack has been divided into three partial receiving chambers by means of horizontal compartment floors 15. The partial receiving chambers can be covered on both sides by means of lateral covers 16. Each of the lateral covers has an air inlet 14 and a venting opening 13. The narrow sides at the front and rear, as well as the roof, of the rack 15 are covered by suitable panels. The compartment floors 15 are fastened at the vertical profiled frame element 13 and each is used for receiving a cooling module 20. In this case each cooling module is put together from two components, a heat exchanger unit 21 and a fan unit 24.

The heat exchanger unit 21 has a heat exchanger housing 25, into which an air-water heat exchanger 22 has been inserted. The heat exchanger housing 25 has two outlet openings 23, which can be arranged aligned with the venting opening 13 of the covers 16.

The fan unit 24 has a fan housing 26, which receives two fans 24. The fan housing 26 is in an air-conducting connection via its open sides 27 with the air inlets 14 of the covers 16.

For mounting the cooling module 20, the heat exchanger unit 21 is pushed through the open front of the rack between the two vertical profiled frame elements 13 on the compartment floor 15 into the assigned partial receiving chamber until the heat exchanger housing 25 limits the insertion movement at a stop 18 of the covers 16. In the same way a fan unit 24 is pushed on the compartment floor 15 used as a sliding guide into the partial receiving chamber from the direction of the rear of the rack. Again the stop 18 limits the insertion movement.

The cooling device 10 represented in Fig. 1 can be installed in a device arrangement such as shown by way of example in Fig. 2. Here, the cooling device 10 has been installed between two switchgear cabinets 30. The switchgear cabinets 30 have a conventional structure and have a frame screened by wall elements and a door at the front. The cooling device 10 replaces the wall element at the switchgear cabinet sides facing each other.

As can be seen in the drawings, the switchgear cabinets 30 are each equipped with two server units (electrical built-ins 31). In this case one server unit each is arranged in the roof and the bottom areas of the switchgear cabinet 30. An empty space exists between the two server units which can be equipped, when needed, with a third server unit for making the interior of the switchgear cabinet complete.
Corresponding to the occupation of the switchgear cabinet 30, the cooling device 10 contains two cooling modules 20. Each one of the cooling modules 20 is in spatial connection with the interiors of both switchgear cabinets via the air inlets 14 and the exhaust openings 23. Air can be conveyed in the direction toward the switchgear cabinet interior by means of the fan units 24 over a conduit structure of the server units. This air is cooled in the heat exchanger 22 of the heat exchanger unit 21 and is then again conducted to the conduit structure in the area of the front of the switchgear cabinets 30 through the venting openings 13. If at a later time the switchgear cabinets 30 are to be retrofitted with a third server unit, it is possible in a simple manner to also retrofit a third cooling module 20 in the cooling device 10.

If only one server unit is to be retrofitted in one switchgear cabinet 30, a cover 16 which does not permit the

passage of air is installed toward the other switchgear cabinet 30. It is possible in this way to adapt all partial receiving chambers to the respective individual installation conditions in the switchgear cabinet 30.

The cooling device can also be installed by itself in only one switchgear cabinet. The side of the cooling device facing away from the switchgear cabinet 30 is then closed off by means of a lateral wall.